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# Bank of Canada Monthly Research Update

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April 2021

This monthly newsletter features the latest research publications by Bank of Canada economists. The report includes papers appearing in external publications and staff working papers published on the Bank of Canada's website.

## PUBLISHED PAPERS

### In-Press

Chapman, James & Desai, Ajit, “Using payments data to nowcast macroeconomics variables during the onset of Covid-19”, Journal of Financial Market Infrastructures, Vol 9(1): 1-29, March 2021

### Forthcoming

MacGee, James (Jim) C. & Pugh, Thomas Michael & See, Kurt, “The Heterogeneous Effects of COVID-19 on Canadian Household Consumption, Debt and Savings”, Canadian Journal of Economics

Lu, Zhentong & Zhang, Sisi & Hong, Jian, “Examining the Impact of Cooling Measures on China’s New Home Market”, China Economic Review

Mo, Kun & Suvankulov, Farrukh & Griffiths, Sophie, “Financial distress and commodity hedging: Evidence from Canadian oil firms”, Energy Economics

Acharya, Sushant & Benhabib, Jess & Huo, Zhen, “The Anatomy of Sentiment-driven Fluctuations”, Journal of Economic Theory

Acharya, Sushant & Dogra, Keshav, “The Side Effects of Safe Asset Creation”, Journal of the European Economic Association

Rios, Antonio Diez de los, “A Macroeconomic Model of an Epidemic with Silent Transmission and Endogenous Self-isolation”, Canadian Journal of Economics

## STAFF WORKING PAPERS

Chiu, Jonathan & Wong, Tsz-Nga, “Payments on Digital Platforms: Resiliency, Interoperability and Welfare”, Bank of Canada Staff Discussion Paper 2021-19

Galassi, Gabriela, “Labor Demand Response to Labor Supply Incentives: Lessons from the German Mini-Job Reform”, Bank of Canada Staff Discussion Paper 2021-15

MacKenzie, Gaelan, “Trade and Market Power in Product and Labor Markets”, Bank of Canada Staff Discussion Paper 2021-17

Bowlus, Audra & Gouin-Bonenfant, Émilien & Liu, Huju & Lochner, Lance & Park, Youngmin, “Four Decades of Canadian Earnings Inequality and Dynamics Across Workers and Firms”, Bank of Canada Staff Discussion Paper 2021-20

Jiang, Janet Hua & Puzzello, Daniela & Zhang, Cathy, “How Long is Forever in the Laboratory? Three Implementations of an Infinite-Horizon Monetary Economy”, Bank of Canada Staff Discussion Paper 2021-16

## STAFF DISCUSSION PAPERS

Fudurich, James & Suchanek, Lena & Pichette, Lise, “Adoption of Digital Technologies: Insights from a Global Survey Initiative”, Bank of Canada Staff Discussion Paper 2021-7

García, Alejandro & Lands, Bena & Yanchus, Dennis, “Stablecoin Assessment Framework”, Bank of Canada Staff Discussion Paper 2021-6

## ABSTRACTS

### *Using payments data to nowcast macroeconomics variables during the onset of Covid-19*

The Covid-19 pandemic and its resulting public health mitigation measures have caused large-scale economic disruption globally. At this time, there is an increased need to predict the macroeconomy's short-term dynamics to ensure the effective implementation of fiscal and monetary policy. However, economic prediction during a crisis is challenging because of the unprecedented economic impact of such an event, which increases the unreliability of traditionally used linear models that employ lagged data. We help to address these challenges by using timely retail payments system data in linear and nonlinear machine learning models. We find that, compared with a benchmark, our model has a roughly 15–45% reduction in root mean square error when used for macroeconomic nowcasting during the global financial crisis. For nowcasting during the Covid-19 shock, our model predictions are much closer to the official estimates.

### *The Heterogeneous Effects of COVID-19 on Canadian Household Consumption, Debt and Savings*

This paper develops an agent-based modelling approach to quantify the impact of COVID-19-induced economic disruptions on household debt and unplanned savings over 2020. We merge data from the Survey of Financial Security and the Survey of Household Spending to construct a representative cross-section of households who vary in their income, debt portfolios and mix of consumption expenditures. We simulate a series of individual and aggregate shocks to household income and consumption expenditures that incorporate government policies such as Canadian Emergency Response Benefit (CERB) as well as shifts in consumption expenditures across hard-to-distance goods (e.g., travel, restaurants) and easy-to-distance goods (e.g., groceries). Differential impact on household incomes resulting from unemployment and reduced hours play an important role in driving household debt and savings. We highlight two other important channels. First, income replacement programs (notably CERB) only partially replace lost income for unemployed, previously middle-income households—which drives a rise in borrowing, particularly for those with mortgages. Second, upper-income households have relatively larger expenditures on hard-to-distance goods and so experience larger declines in consumption expenditures. This contributes to the high savings observed during March and April.

### *Examining the Impact of Cooling Measures on China's New Home Market*

This paper studies the impact of home purchase restrictions on China's housing market. We estimate a structural model of household preference for housing, real estate developers' pricing decisions, and equilibrium market outcome in five large cities. By comparing the estimation results from pre- and post-policy intervention, we find that, after home purchase restrictions are implemented, overall housing demand in most cities becomes weaker and less price elastic; meanwhile, real estate developers face higher holding costs and thus are willing to lower prices and sell more quickly. Counterfactual analyses show that in some cities alternative policy designs that cause less structural change of demand could achieve larger consumer welfare and social welfare than the implemented policy.

### *Financial distress and commodity hedging: Evidence from Canadian oil firms*

Properly implemented risk management practices can help maximize shareholder value by reducing the expected cost of financial distress, and as such firms in deeper financial distress are expected to hedge more. However, empirical studies on such relationship have yielded mixed results. This paper documents the main determinant of hedging decisions using a newly assembled dataset for 92 Canadian-based, publicly traded oil extraction companies between 2005 and 2015. We adopt empirical techniques - Honoré's semiparametric model and simultaneous equations with the minimum distance estimator - that explicitly deal with issues that frequently arise when studying hedging decisions, namely a clustering of firms that choose to not hedge at all and the endogeneity associated with concurrent determination of hedging and borrowing decisions. Even after controlling for endogeneity and other possible drivers of hedging, we still detect a positive and statistically significant relationship between a firm's perceived financial distress and the degree to which it hedges.

### *The Anatomy of Sentiment-driven Fluctuations*

We show that sentiments - self-fulfilling changes in beliefs that are orthogonal to fundamentals - can drive persistent aggregate fluctuations under rational expectations in a beauty-contest game. Such fluctuations can occur even in the absence of any exogenous aggregate fundamental shocks. In addition, sentiments alter the volatility and persistence of aggregate outcomes in response to fundamental changes. We provide (i) necessary conditions under which sentiments can affect aggregate outcomes in equilibrium and (ii) conditions under which sentiments drive persistent fluctuations and when they only affect aggregate outcomes contemporaneously. We also show that sentiment equilibria are stable under learning while the fundamental equilibrium is not.

### *The Side Effects of Safe Asset Creation*

We present an incomplete markets model to understand the costs and benefits of increasing government debt when an increased demand for safety pushes the natural rate of interest below zero. A higher demand for safe assets causes the ZLB to bind, increasing unemployment. Higher government debt satiates the demand for safe assets, raising the natural rate, and restoring full employment. However, this entails permanently lower investment, which reduces welfare, since our economy is dynamically efficient even when the natural rate is negative. Despite this, increasing debt until the ZLB no longer binds raises welfare when alternative instruments are unavailable. Higher inflation targets instead allow for negative real interest rates and achieve full employment without reducing investment.

### *A Macroeconomic Model of an Epidemic with Silent Transmission and Endogenous Self-isolation*

We study the interaction between epidemics and economic decisions in a model where (1) agents allocate their time to market and home production and social and home leisure, (2) these activities differ in their degree of contagiousness, (3) some infected individuals are indistinguishable from susceptible individuals, and (4) agents are not necessarily rational. For baseline parameter values for the COVID-19 pandemic, we find that agents partially self-isolate by allocating more time to home activities and that the effective reproduction number of the disease stabilises at one. Detection and isolation of infected individuals severely mitigate the recession caused by the pandemic.

### *Payments on Digital Platforms: Resiliency, Interoperability and Welfare*

Digital platforms, such as Alibaba and Amazon, operate an online marketplace to facilitate transactions. This paper studies a platform's business model choice between accepting cash and issuing tokens, as well as the implications for welfare, resiliency, and interoperability. A cash platform free rides on the existing payment infrastructure and profits from collecting transaction fees. A token platform earns seigniorage, albeit bearing the costs of setting up the system and holding reserves to mitigate the cyber risk. Tokens earn consumers a return, insulating transactions from the liquidity costs of using cash, but also expose them to the remaining cyber risk. The platform issues tokens if the interest rate is high, the platform scope is large, and the cyber risk is small. Unbacked floating tokens with zero transaction fees or interest-bearing stablecoins can implement the equilibrium business model, which is not necessarily socially optimal because the platform does not internalize its impacts on offplatform activities. The model explains why Amazon does not issue tokens but Alipay issues tokens circulatable outside its Alibaba platforms. Regulations such as a minimum reserve requirement can reduce welfare.

### *Labor Demand Response to Labor Supply Incentives: Lessons from the German Mini-Job Reform*

This paper analyzes how firms respond to changes in tax benefits for low-earning workers and how, through equilibrium effects, such policies also affect non-targeted, high-earning workers. I explore establishment-level outcomes around Germany's 2003 Mini-Job Reform, which entailed a significant expansion of tax benefits for low-earning workers. Firms' responses are decomposed in terms of the scale effects that arise from lower labor costs and the substitution effects that are due to changes in the relative prices of low- and high-earning employment post-reform. Using a differences-in-differences approach, I document that highly exposed establishments—those with a high proportion of low-earning workers pre-reform—expand their number of employees relative to non-exposed establishments—those with a low proportion of such workers. Importantly, this relative expansion is tilted towards high-earning workers, a group that is not the target of the tax benefits. In addition, non-exposed establishments substitute employment towards low-earning workers without expanding at the same pace. My findings are consistent with a model

of the labor market that features tax sharing between workers and firms and simultaneous shifts in labor supply and demand after changes in tax benefits for low-earning workers. In this setting I illustrate that the employment growth the policy intended is accompanied by a reallocation of employment and production between highly exposed firms and non-exposed firms, and this may result in an efficiency loss.

### *Trade and Market Power in Product and Labor Markets*

This paper studies the effects of endogenous firm-level market power in input and product markets on equilibrium prices and wages as well as the gains from trade using a general equilibrium model with heterogeneous firms. Firm-level prices and wages are functions of two endogenous distortions: (i) a markup of price over marginal cost that depends on product market shares and (ii) a markdown of wages relative to marginal revenue product that depends on labor market shares. Both distortions cause large firms to be too small relative to local labor market competitors compared to a setting with perfect competition in input and product markets. Opening product markets up to trade reallocates market shares in product and labor markets towards countries' large firms, which can reduce misallocation but also increases the labor market power of these firms. After estimating the structural parameters of the model using Indian plant-level data, I show that accounting for endogenous labor market power implies only small welfare losses due to misallocation and therefore a negligible increase in the gains from trade. Trade has significantly larger effects on firms' markups than on their markdowns. Nevertheless, because of the increase in large firms' input market power, there is a redistribution of the gains from trade from wages to firm profits.

### *Four Decades of Canadian Earnings Inequality and Dynamics Across Workers and Firms*

This paper studies the evolution of individual earnings inequality and dynamics in Canada from 1983 to 2016 using tax files and administrative records. Linking these individuals to their employers (and rich administrative records on firms) beginning in 2001, it also documents the relationship between the earnings dynamics of workers and the size and growth of their employers. It highlights three main patterns over this period: First, with a few exceptions (sharp increase in top 1% and declining gender gap), Canada experienced relatively modest changes in overall earnings inequality, volatility, and



mobility between 1983 and 2016. Second, there is considerable variability in earnings inequality and volatility over the business cycle. Third, the earnings dynamics of individuals are strongly related to the size and employment growth of their employers.

### *How Long is Forever in the Laboratory? Three Implementations of an Infinite-Horizon Monetary Economy*

We compare three implementation schemes of an infinite-horizon monetary economy with discounting. Under the standard random termination scheme and its block variation, the economy lasts for an indefinite number of periods and the discounting factor is captured by the probability that the economy continues to the next period. These schemes rely on the belief that the experimenter can credibly implement a game that lasts an arbitrarily long time. We also propose a new method that does not rely on such a belief. Under this scheme, subjects participate in an experiment for a fixed number of periods where the discount factor is captured by a weighting factor that shrinks the payoffs over time. Dynamic incentives are preserved by paying subjects their continuation value, which is based on past market prices. The results show that dynamic incentives are preserved, and behavior is similar in all three implementations. Researchers may decide among these approaches, depending on the research question of interest and more practical concerns, such as the ease of implementation and the need to collect data for multiple supergames when the discount factor is high.

### *Adoption of Digital Technologies: Insights from a Global Survey Initiative*

The Bank of Canada, together with a global network of central banks, recently surveyed more than 6,000 firms from around the world. Using the survey data, this paper assesses the effects of digitalization on firms' pricing and employment decisions. Specifically, we examine firms' expectations about how their adoption of digital technologies—such as e-commerce, cloud computing, big data, 3-D printing, the Internet of Things, robotics and artificial intelligence—will affect their prices and hiring plans. Digital technologies influence firms' operations in several ways that can often offset each other. This makes it difficult to pin down the overall impact on prices. Survey results for Canada suggest that some firms expect some downward pressure on prices from (1) efficiency gains, for example from automation, made possible by digital technology and (2) increased online competition and cost compression in the supply chain. Other

firms expect that the value added to their products from adopting digital technologies will allow them to charge higher prices. In addition, some firms anticipate that they will have to pass on the costs of adoption to customers. Firms also expect a marginal negative effect on their employment over the next three years as a result of technology induced automation or productivity gains. This negative effect will largely be offset by more hiring of digital talent or to accommodate stronger sales. Using matching techniques to control for differences in sample size and composition as well as survey frames, we find that, compared with small and medium-sized firms, large firms are more likely to adopt digital technologies and more likely to expect negative effects on both employment and prices.

### *Stablecoin Assessment Framework*

We outline a three-step framework to investigate stablecoin arrangements and quantitatively assess their risk. The first step is to classify the stablecoin arrangement into three parts—coin structure, transfer system(s) and financial service(s)—and categorize the attributes of each part. The second step is to identify specific risk scenarios. The third is to quantify the range of probable loss and range of possible frequency associated with the identified risk scenarios. Our proposed framework allows authorities to understand the defining characteristics of stablecoin arrangements, to be specific about any concerns they may have, and to be objective in their treatment from issuer to issuer. Additionally, the process we are proposing ensures that authorities and the stablecoin issuer can come to a quantitatively based understanding about the potential risks. The main contributions we make are to separate stablecoins arrangements into three activity-based components and to apply an operational risk management approach to quantifying risks of stablecoins.

## UPCOMING EVENTS

**\* All onsite conferences and events are suspended until further notice. All events listed below will take place virtually.**

Lindsay Relihan (London School of Economics)  
Organizer: CUR EFR Visiting Speaker Series  
Date: 10 May 2021

Eric Swanson (University of California, Irvine)  
Organizer: FMD / FSD EFR Seminar Series  
Date: 13 May 2021

Jennifer La'O (Columbia University)  
Organizer: EFR CEA/INT Speaker Series  
Date: 14 May 2021

Alessandro Bonatti (Massachusetts Institute of Technology)  
Organizer: BAP Virtual Speaker  
Date: 17 May 2021

Stijn Van Nieuwerburgh (Columbia University)  
Organizer: FMD / FSD EFR Seminar Series  
Date: 20 May 2021

Yueran Ma (Chicago Booth)  
Organizer: EFR CEA/INT Speaker Series  
Date: 21 May 2021

Emi Nakamura (University of California, Berkeley)  
Organizer: FMD / FSD EFR Seminar Series  
Date: 27 May 2021

Andre Kurmann (Drexel University)  
Organizer: EFR CEA/INT Speaker Series  
Date: 28 May 2021

Stephen Hansen (Imperial College London and CEPR)  
Organizer: FBD Virtual Speaker  
Date: 7 June 2021

Saki Bigio (UCLA)  
Organizer: FMD / FSD EFR Seminar Series  
Date: 10 June 2021